

**The  
Connection Machine  
System**

# **CMAX Release Notes**

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**Version 1.0**

**July 1993**

**Thinking Machines Corporation  
Cambridge, Massachusetts**

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# Customer Support

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Thinking Machines Customer Support encourages customers to report errors in Connection Machine operation and to suggest improvements in our products.

When reporting an error, please provide as much information as possible to help us identify and correct the problem. A code example that failed to execute, a session transcript, the record of a backtrace, or other such information can greatly reduce the time it takes Thinking Machines to respond to the report.

If your site has an applications engineer or a local site coordinator, please contact that person directly for support. Otherwise, please contact Thinking Machines' home office customer support staff:

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# CMAX Release Notes

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## 1 About Version 1.0

Version 1.0 is the first final release of the CMAX Converter, after extensive field testing.

Field-test users who are upgrading to this final release will notice greater robustness but no significant changes in functionality in comparison with the last beta release. However, if you have **CMAX** subdirectories (containing packages and other CMAX-generated files) that were created under a field-test version, you should remove these directories and allow CMAX to create them anew under Version 1.0.

## 2 About CMAX

CMAX — the CM Automated X-lator — is a tool that converts standard Fortran 77 into CM Fortran.

CMAX provides a convenient migration path for serial Fortran programs onto the massively parallel Connection Machine system, both for data parallel applications and for CM Fortran/CMMD message-passing applications. In addition, CMAX gives users the option of maintaining their software in Fortran 77 for maximum portability to multiple platforms, by serving as a “preprocessor” for routine CM Fortran compilation.

The major capabilities of CMAX are:

- DO loop vectorization, which entails dependence analysis and a number of vectorization techniques (idiom recognition, loop fissioning, scalar promotion, and so on). DO loops in the input program become array operations in the output program.
- Generating array home directives, by which CMAX directs the CM Fortran compiler to allocate arrays either in the linear memory of the control processor or in the distributed memory of the parallel processing unit.
- For CM Fortran/CMMD programs, the *control processor* refers to each SPARC node in a CM-5 system; arrays are distributed across the four vector units associated with each node, and the vector units process the vectorized loops. CMAX output executes in this model as well as in the data parallel CM Fortran model.
- Interprocedural analysis and procedure cloning, by which CMAX enhances vectorization and also guarantees that its output meets CM Fortran requirements for passing distributed arrays as arguments (generating variants of procedures if necessary).
- The CMAX library, which provides convenient, portable Fortran 77 routines to express dynamic array allocation (and other operations not provided in Fortran 77). These library routines execute on any Fortran 77 system, and can be translated by CMAX into CM Fortran dynamic array allocation and other Fortran 90 features.

CMAX provides a convenient interface to the user. It is invoked either from a shell or from within the Prism development environment. Prism provides facilities for examining CMAX output and comparing it line-by-line with input. In addition, CMAX provides a number of command options and in-line directives that enable the user to control its actions and decision rules.

## 3 For More Information

### 3.1 User Documentation

The following items can be found in `/usr/doc` on CM-5 systems, and in `/usr/cm/doc` on CM-2/200 systems. See your system administrator for the location if these files have been moved.

- *Using the CMAX Converter*, Version 1.0, July 1993

This manual describes all the visible features of CMAX (its command options, directives, and library), as well as many of its internal conversion capabilities. It is available in hardcopy or on-line in postscript format.

- `cmx-1.0.bugupdate`

This ASCII file reports all bugs known at the time of the release.

- `cmx-1.0.releasenotes`

This file is an ASCII version of these release notes. The release notes are also available in postscript format and in hardcopy.

The following items are accessible from the CMOST or UNIX shell.

- `cmx` command manual page

The man page is accessible via the command `man` on CM-5 systems and `cmman` on CM-2/200 systems. It describes the three `cmx` command modes (information, package operation, and package translation), as well as all the options, libraries, and other files supported.

- `cmx` command option `-Help`

Invoking the `cmx` command with option `-Help` causes CMAX to display a list of all supported command modes and options.

## 3.2 Other On-Line Assistance

The following items can be found in `/usr/examples/cmax` on CM-5 systems, and `/usr/cm/examples/cmax` on CM-2/200 systems:

- Sample makefiles for conversion and compilation, for both global CM Fortran and CM Fortran/CMMD (“nodal CM Fortran”). Some Fortran 77 `.f` files are included for trial conversions.
- Sample implementation of some Gnu Emacs utilities that help in the conversion process, including one that lets you view CMAX input, output, and explanatory notes in adjoining windows.
- Source code for the CMAX serial dynamic allocation library, which may be compiled for any Fortran 77 platform.

# 4 CM System Compatibility

## 4.1 To Run the Converter

The CMAX Converter runs on a Sun-4 (SPARC) computer. This platform may be a CM-5 partition manager, a front end to a CM-200 or CM-2, or a suitably licensed standalone server.

## 4.2 To Compile Converter Output

The converter’s output program can be compiled under any version of CM Fortran, from Version 1.2 onward.

The converter’s output program can be compiled for any CM system — CM-5, CM-200, or CM-2 — and for any execution model (including the CM simulator and including nodal CM Fortran with CMMD message passing).

Some converter output needs to be linked with the CMAX library for the appropriate CM platform. See *Using the CMAX Converter* for information.



### 4.3 To Examine Converter Output

The converter's output program can be compiled for execution under the Prism development environment and examined with Prism's debugging and performance analysis tools. Prism also provides split-window facilities for comparing the converter's input and output files, along with the relevant messages explaining conversion decisions.

EMACS editors can be customized to provide helpful tools (described in *Using the CMAX Converter*) for converting subprograms and for comparing CMAX's input and output files. A sample implementation of these tools is provided online, as noted in Section 3.2 above.